NOTES ON THE NESTING HABITS OF BEMBEX NUBILIPENNIS.

By J. B. PARKER.

While engaged in field work at Wilson, Kansas, in August, 1909, I chanced upon the nesting site of a large solitary wasp that proved to be Bembex nubilipennis. The wasps of this species, known in that locality as "yellow jackets," are handsome insects, exceedingly fast on the wing and alert, nervous and cautious when about their nests. Though they are solitary wasps they nest in colonies and the nesting site under observation was in a driveway leading from the public road into a barnyard, where the earth in which the nests were placed was trampled so hard that much difficulty was experienced in opening them. The owner of the place stated that these wasps had nested there annually for a number of years and his statement was borne out by the number of old burrows discovered during the investigation.

The burrows, penetrating to a depth of six or eight inches, enter the ground at an angle of about forty-five degrees; but there is no very great uniformity in this respect. At a distance of from eight to twelve inches from the entrance lateral branches are given off, which serve as brood chambers for the larvae. At the time of my observation no burrow was found with more than five of these chambers; most had four and a few had only three. In the chambers more than one larva may be reared, in which case the first is placed at the extreme end of the chamber and when full grown and encased a wall is placed across the chamber and another larva reared between this and the main part of the burrow.

The wasp in digging uses the first pair of legs, turning the tarsi inward so as to make a pair of rakes out of the stout spines borne on the posterior sides of these segments. At that time the dust of the surface of the driveway lay about an inch deep and the horses in passing back and forth over the nests completely changed the appearance of the surface several times a day. But this did not seem to bother the wasps a great deal, for they almost invariably digged down through the dust directly to the mouth of a burrow. The burrow thus found, however, did not always prove to be the one desired; in fact, one wasp was observed to dig into three different burrows before she found the one she sought. Whether the first two opened were hers also or the property of another wasp I had no means of finding out in the brief time at my command. On leaving the nest the wasp not only closes up the entrance but also carefully conceals all traces of it, so carefully, indeed, that she has quite as much trouble at times in finding the entrance as she does when the horses have

disturbed appearances. Whenever the nest is entered the opening is likewise always closed up from the inside.

These observations were made on August 18 and 19, and although many burrows were opened only larvae were found. Many of these had completed their growth and were encased in cells of earth held together by some cement substance and lined inside with delicate silk; but in every instance an immature larva in some stage of development was also found in the burrow. In no case, however, was more than one developing larva found in any burrow. In one burrow with four branches there contained matured and encased larvae and the fourth, just newly constructed, contained two recently killed house-flies, on one of which was found an unhatched egg. From the data given above it would appear that the wasp rears only one larva at a time, unless perchance she constructs and attends two or more burrows at the same time, the necessity for which is not apparent.

The food of the larva, as shown by the nests opened, consists wholly of flies and it seems that certain females show a preference for a particular kind of fly. In one nest only house-flies were found; in a second the majority were stable-flies; in a third, flesh-flies; in a fourth, tachina-flies. The wings, legs and usually the thorax of the fly are not consumed by the larval wasp. The remains of forty-one flies, of which most, perhaps all, were house-flies, were taken from a chamber containing an almost mature larva, and doubtless these were not the total number of flies consumed by this individual. In the evening from a chamber containing a half-grown larva ten untouched flies were taken, among which were represented the following species kindly identified for me by Prof. J. S. Hine: Euphorocera claripennis, Pseudopyrelia cornicina, Sarcophaga assidua, and Sarcophaga helicis.

According to my limited observations all burrows containing immature larvae are closed up at nightfall with the female inside the nest. The popular belief is that the male closes up the burrow from without after the female has entered the nest for the night, but I saw nothing that would tend to confirm this opinion. The lad that helped me to open the burrows stated that he had often drowned the wasps out of their nests and that he usually chased two out of each nest. From the manner in which he described the proceedings I fear the fun he got out of the operation is more worthy of credence than is the accuracy of his observations, for in no instance did I get more than one wasp from a burrow and all thus taken were females. Unfortunately, I had no net with me and hence was unable to determine whether any males were among the numbers that were continually darting about over the nesting site, though I suspect that such was the case.

A small species of fly, presumable a tachinid, was observed very active about the entrances to the burrows, and it was amusing to watch these little rascals, one or more of which were usually on hand whenever a burrow was being opened. The wasp seems very nervous when opening her nest, frequently pausing in her task to run hither and thither about the half-opened entrance or to rise on the wing and buzz around at varying distances from it. But no matter what the circumstances were the little fly always faced the wasp, seeming to realize that its safety lay in its vigilance; and the rapidity with which it would face about or dart from side to side as the wasp moved about it, left little room to doubt that it was up to some sort of mischief. If the wasp moved away from the opening to any great distance the fly would dash into the burrow and in an instant pop out again at a lively pace; but in the instances observed the fly accomplished nothing by its bold dashes, for the wasp had not opened the burrow deep enough to permit the fly to reach the brood chamber. Frequently as the wasp entered her nest one, and sometimes several, of these flies would dash into the entrance behind her, only to have their eyes flung full of dirt by the cautious wasp as she closed up the opening from within.

Just what business these little rascals had in the burrow I failed to make out. Perhaps they sought to parasitize the larva of the wasp or perhaps to place their eggs upon the food provided for it. I found no evidence of parasitism but in two instances I found small larvae of some sort feeding on the flies in a chamber containing an immature larval wasp. That enemies are feared by the wasp seems evident from the fact that the entrance to the nest is never left open even when the wasp is inside it.

One man complained of these wasps, insisting that they stung his horses when at work in the fields. But the presence of large numbers of stable-flies in the brood chambers shows that the wasp is a friend of the horse, not an enemy as my friend had supposed. The fact that they attack the housefly is also much to their credit, but the presence of tachina-flies among the food of the larvae indicates that their habit of preying on flies is not wholly commendable. The extent of my investigation, however, was too limited to permit me to hazard an opinion as to their economic position.